Public Works Canada
Solar Programs Office

THE PUSH PROCESS

Project Funding Procedures for Solar Heating Installations under the PUSH Program

March 1981

Enquiries:

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I: THE PUSH PROGRAM

1. FEDERAL SOLAR PROGRAMS AND SOLAR PROGRAMS OFFICE (SPO)

The federal government's solar programs effort is part of a $380 million Canadian renewable energy development program announced in July 1978. The overall goal is to help achieve energy self-sufficiency by 1990 by conserving non-renewable resources such as oil and by investing in means of exploiting renewable energy sources.

The Solar Programs Office (SPO) within Public Works Canada administers three solar energy programs on behalf of the federal government. These programs are:

- Purchase and Use of Solar Heating (PUSH): ongoing;
- Program of Assistance to Solar Equipment Manufacturers (PASEM): completed 1980;
- Low Energy Building Design Awards (LEBDA): completed 1980.

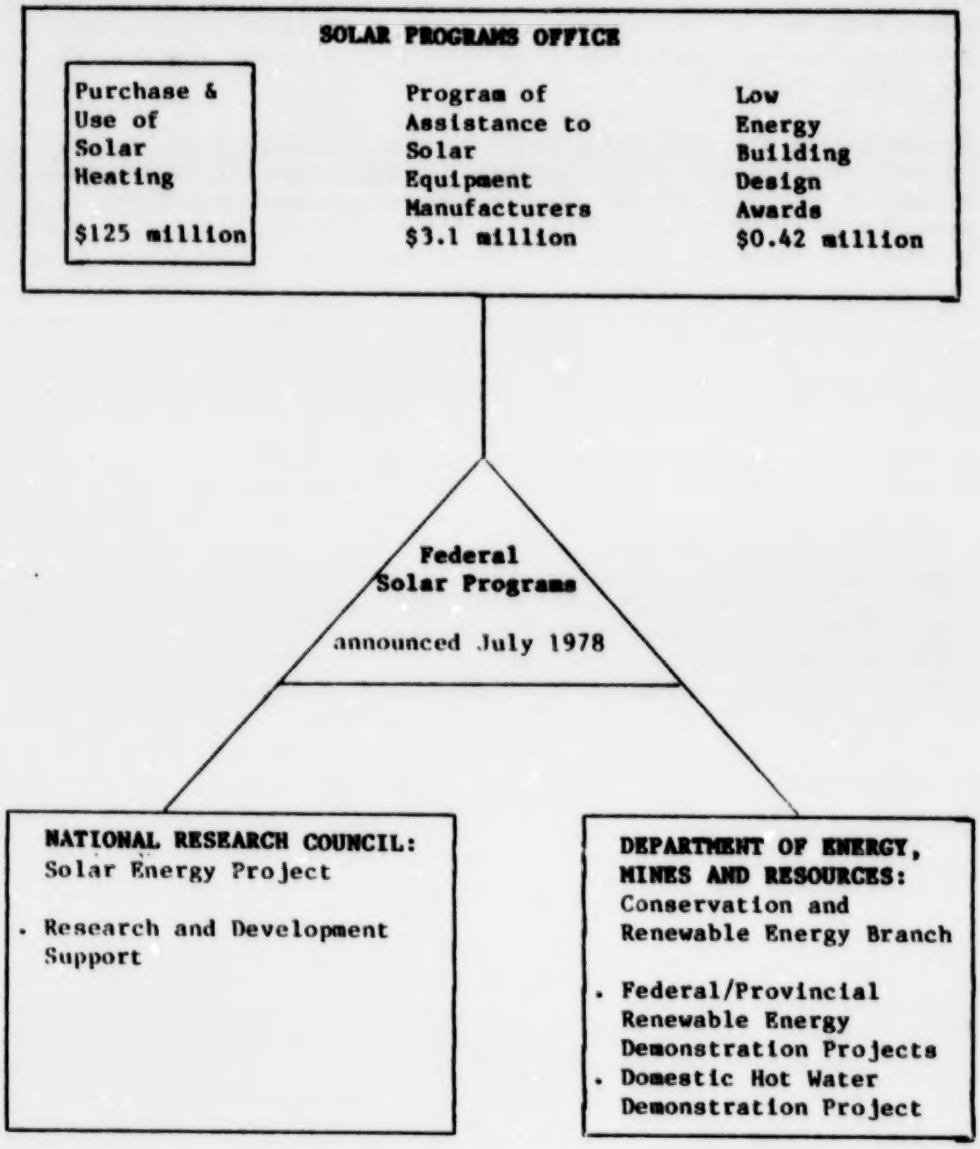
Under the PUSH program, solar heating systems are being installed in selected federal facilities to provide an initial market for Canada's new solar manufacturing and design industry. The PASEM program comprised shared-cost contracts with 10 Canadian firms, selected through national competition, to refine solar heating systems and components and to develop production and marketing capabilities. LEBDA was a national competition for the design of low-energy buildings. Further information on PASEM and LEBDA is available on request from SPO.

Research and development support is administered by the National Research Council.* In addition, funds have been allocated for federal/provincial solar demonstration projects managed by the Department of Energy, Mines and Resources.**

*Information: Solar Energy Project
National Research Council
Montreal Road
Ottawa K1A 0R6

**Information: Conservation and Renewable Energy Branch
Department of Energy Mines and Resources
Ottawa K1A 0A6

FEDERAL SOLAR PROGRAMS


SOLAR PROGRAMS OFFICE
Purchase & Use of Solar Heating
$125 million
Program of Assistance to Solar Equipment Manufacturers
$3.1 million
Low Energy Building Design Awards
$0.42 million
Federal Solar Programs
announced July 1978
NATIONAL RESEARCH COUNCIL:
Solar Energy Project
. Research and Development Support
DEPARTMENT OF ENERGY, MINES AND RESOURCES:
Conservation and Renewable Energy Branch
. Federal/Provincial Renewable Energy Demonstration Projects
. Domestic Hot Water Demonstration Project

2. PUSH OBJECTIVES

The PUSH program aims to support the development of an integrated Canadian solar industry by funding the installation of solar heating systems for buildings and facilities owned by federal government departments, agencies and Crown corporations.

By purchasing and installing solar heating equipment, the federal government is both assuming the risk inherent in a young industry's development and acting as a proving ground for the new technology. The guaranteed market provided by the PUSH program is intended to increase the scale of solar heating equipment manufacturing in Canada and help establish competitively priced high quality products. At the same time, the solar industry infrastructure of designers and installers will benefit from experience gained on a wide variety of PUSH projects. The combination of expertise in design, manufacture and installation is intended to engender public confidence in the use of solar alternatives for space and DHW heating.

By supporting the development of a Canadian solar heating equipment manufacturing industry, the PUSH program's long-term goals are:

- Canadian industrial development
- Regional employment growth
- Development of Canadian technological expertise
- Conservation of non-renewable resources
- Energy self-sufficiency for Canada
- Focus of public attention on proven solar applications.

3. PUSH FUNDS: ELIGIBILITY

Who can apply?

Any Canadian federal government department or agency or federally-chartered Crown corporation that owns or has a major interest in a building or other facility is eligible for PUSH funds for the design and installation of a solar heating system.

What does PUSH pay for?

PUSH funds can be issued for the design, purchase and installation of an active solar system. These expenditures are considered as capital costs for purposes of life-cycle-costing analysis.

4. PUSH AT WORK

Solar energy is being put to work using PUSH funds by the following federal departments and agencies:

Air Canada - Aircraft maintenance facility
Agriculture Canada - Research facilities
Canadair Corporation - Aircraft plant facility and cafeteria
Canadian National Railways - Train washing facilities
Central Mortgage and Housing Corporation - Senior citizens' apartments
Correctional Services Canada - Correctional institutions
de Haviland Aircraft - Manufacturing and assembly plant
Department of Fisheries and Oceans - Fish hatcheries
Department of Indian and Northern Affairs - Indian reserve schools
Department of National Defence - Barracks, swimming pools
Environment Canada - Research laboratory
National Research Council - Material testing laboratory
Parks Canada - Showers and pools, national parks
Public Works Canada - Post Offices and administration buildings
Revenue Canada (Customs and Excise) - Residences and border crossing stations
Royal Canadian Mounted Police - Indoor swimming pools and training facilities
Transport Canada - Air terminal buildings

II: THE PUSH PROCESS

1. INTRODUCTION TO THE PUSH PROCESS

The PUSH process is a procedural system for the funding and development of solar energy projects for planned and existing buildings under the PUSH program. The chief goal of the PUSH process is to describe the stages of interaction between the Solar Programs Office and client departments/agencies. It is understood that project management procedures within those departments/agencies shall apply to the implementation of PUSH projects and that internal functional approvals processes shall be considered by the Project Manager and/or PUSH Coordinator when organizing for the management of specific stages. The generic nature of the PUSH Process dictates that they not be described in detail in this document.

The PUSH process:

- provides an effective sequence of project definition and decision making, from identification to technical evaluation
- sets forth procedures and requirements for the submission of projects for PUSH funding by federal departments and agencies
- outlines criteria and requirements for project evaluation and for project monitoring, and ensures provisions are made for system operation and maintenance
- defines the roles of participants to provide a basis for SPO, implementing departments/agencies, and consultants to work together.

The method and terminology used derive from the Project Delivery System of Public Works Canada. Other departments' or agencies' contractual or project management procedures may dictate use of alternate terms for some stages.

2. PUSH DOCUMENTATION

Each stage of the PUSH Process has a product, which is a document or set of documents that must be submitted in the required format. This will ensure that data is collected and reported in a consistent manner and that PUSH participants can communicate in terms that are understood by all.

I: GUIDELINES AND PROCEDURES

The following PUSH documentation is available or being prepared by SPO for distribution to all PUSH Coordinators, who coordinate information transfer for their organizations.

- **The PUSH Process**
  Step-by-step guide to procedures for procuring solar energy systems using PUSH funds.
- **DHW Package System Procurement Strategy**
  Step-by-step guide to procedures for procuring small domestic hot water systems (150 - 450 litres per day).
- **Architectural and Engineering Concerns in Solar System Design and Operation. October 1979**
  Design guidelines.
- **Identifying Opportunities to Use Solar Heating Equipment under the Federal Government's PUSH Program**
  An aid to identification of potential solar energy applications.
- **PUSH Instrumentation and Commissioning Guidelines: Drain-Down Solar Systems**
  Instrumentation requirements and commissioning procedures for liquid drain-down systems.
- **PUSH Instrumentation and Commissioning Guidelines: Closed Loop Solar Systems**
  Instrumentation requirements and commissioning procedures for liquid closed loop systems.
- **PUSH Instrumentation and Commissioning Guidelines: Air Solar Systems**
  Instrumentation requirements and commissioning procedures for air systems.
- **PUSH Technical Evaluation Guidelines**
  Provides descriptions of the levels of technical evaluation that may be required.
- **Solar System Specification Guide for the PUSH Program Using CMS/NMS, Part I: Mechanical. October 1980**
  An aid in the specification of mechanical components for solar heating systems.

II: INFORMATION TRANSFER

The following PUSH documents are issued by SPO for information reporting purposes throughout the project. They provide a standard format to ensure that information is complete for each stage of the project.

- **PUSH Feasibility Report and Design Funds Application**
  For description of proposed system and application for PUSH funds to produce design.
- **PUSH Design Report**
  For provision of design information, calculations, drawings, and other materials required at the preliminary and final design stages.
- **PUSH Design Review Checklist**
  For completion by the Project Manager when reviewing project designs.
- **PUSH Cost Accounting Handbook**
  Cost reporting system to be followed for all PUSH projects.
- **PUSH Cost Accounting Sheets**
  Contained in the PUSH Cost Accounting Handbook, and available separately, the Cost Accounting Sheets provide a consistent cost reporting format for use throughout all PUSH projects.
- **PUSH Operations Checklist**
  For completion at regular intervals by maintenance staff to provide record of system operation.

III. SYSTEM DOCUMENTATION

The following documents are to be prepared by the designer or contractor to provide a description of the installed system.

- **System Maintenance Manual**
  Provided by the main contractor prior to commissioning to provide guidelines for maintenance staff.
- **System Operations Manual**
  Provided by the designer prior to commissioning to provide the designer's interpretation of the correct operation of the system.

The following documents are required only for those projects selected by SPO for technical monitoring.

- **Technical Evaluation Manual**
  Provided by the designer prior to commissioning to provide a detailed description of the technical evaluation system.
- **Technical Evaluation Checklist**
  Provided by the designer prior to commissioning for completion by maintenance staff for data collection purposes at prescribed intervals throughout the technical evaluation process.

3. PUSH ROLES

The PUSH program defines the following generic roles for the implementation of the PUSH process:

Solar Programs Office
The Solar Programs Office (SPO) within Public Works Canada is responsible for administering PUSH funds and gives financial approvals for PUSH projects. Approval is given on the basis of economic and program considerations.

Implementing Department/Agency
The implementing department/agency is the federal department, agency or Crown corporation responsible for the management, implementation, operation and maintenance of the solar heating installation. The implementing department/agency is usually the owner of the building or facility on which the solar heating system is to be installed.

Departmental PUSH Coordinator
For each implementing department/agency a PUSH Coordinator has been appointed as a contact for SPO. The PUSH Coordinator is responsible for liaison between the implementing department/agency and SPO, ensuring that SPO documentation is distributed to all those involved in PUSH project implementation. The PUSH Coordinator is responsible for submitting funding applications for design and construction of projects on behalf of the department/agency. For some departments/agencies Regional PUSH Coordinators deal with Project Managers in the region of jurisdication and report to the Central Coordinator, whose responsibility is liaison with SPO.
Note: In this Process Document, reference is made only to "the PUSH Coordinator", which should be read to include both Regional and Central functions as applicable.

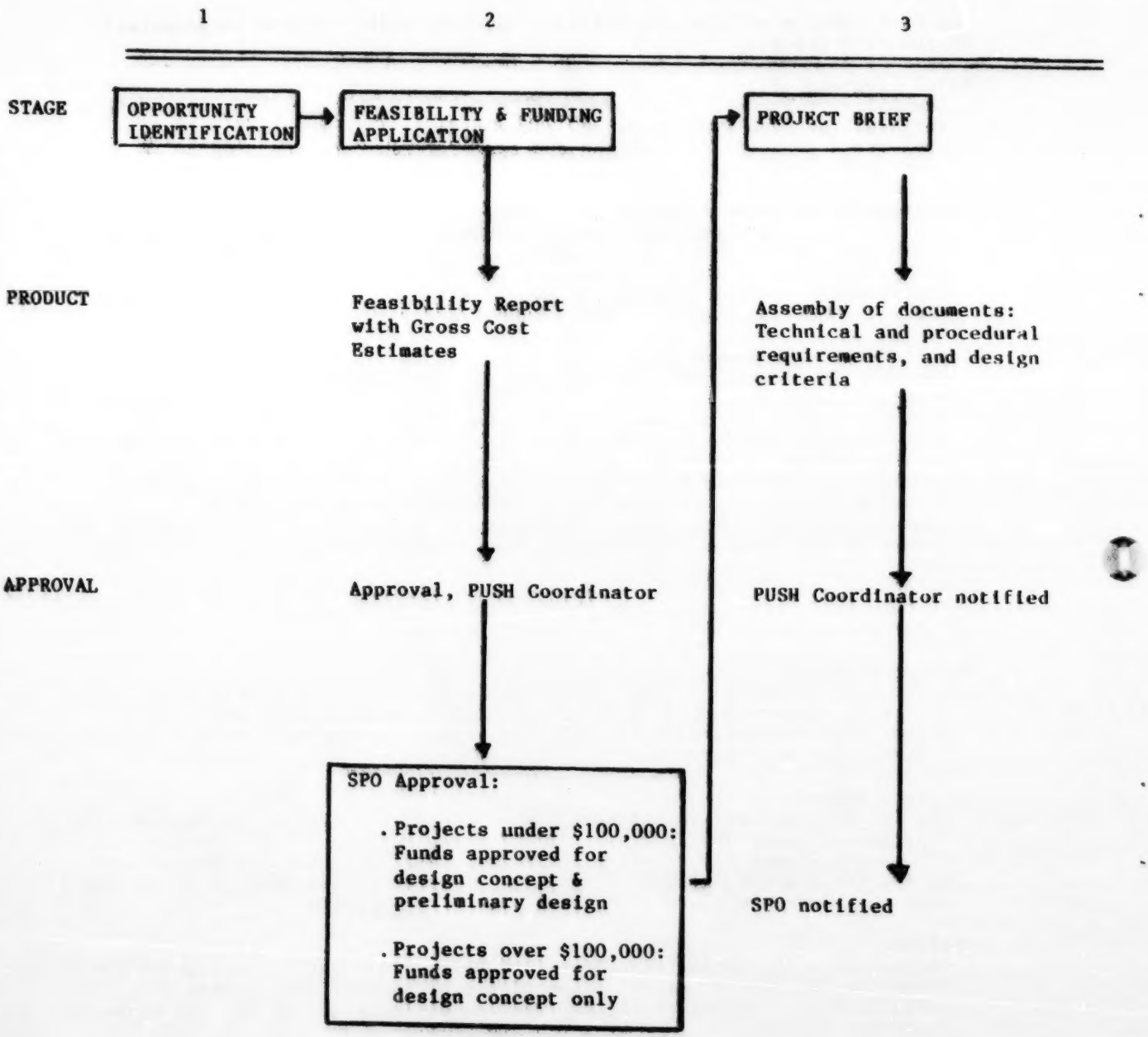
Project Manager
A Project Manager is appointed for each project by the implementing department/agency according to established internal procedures. He is responsible for ensuring that all requirements of the project are met on schedule and on budget.

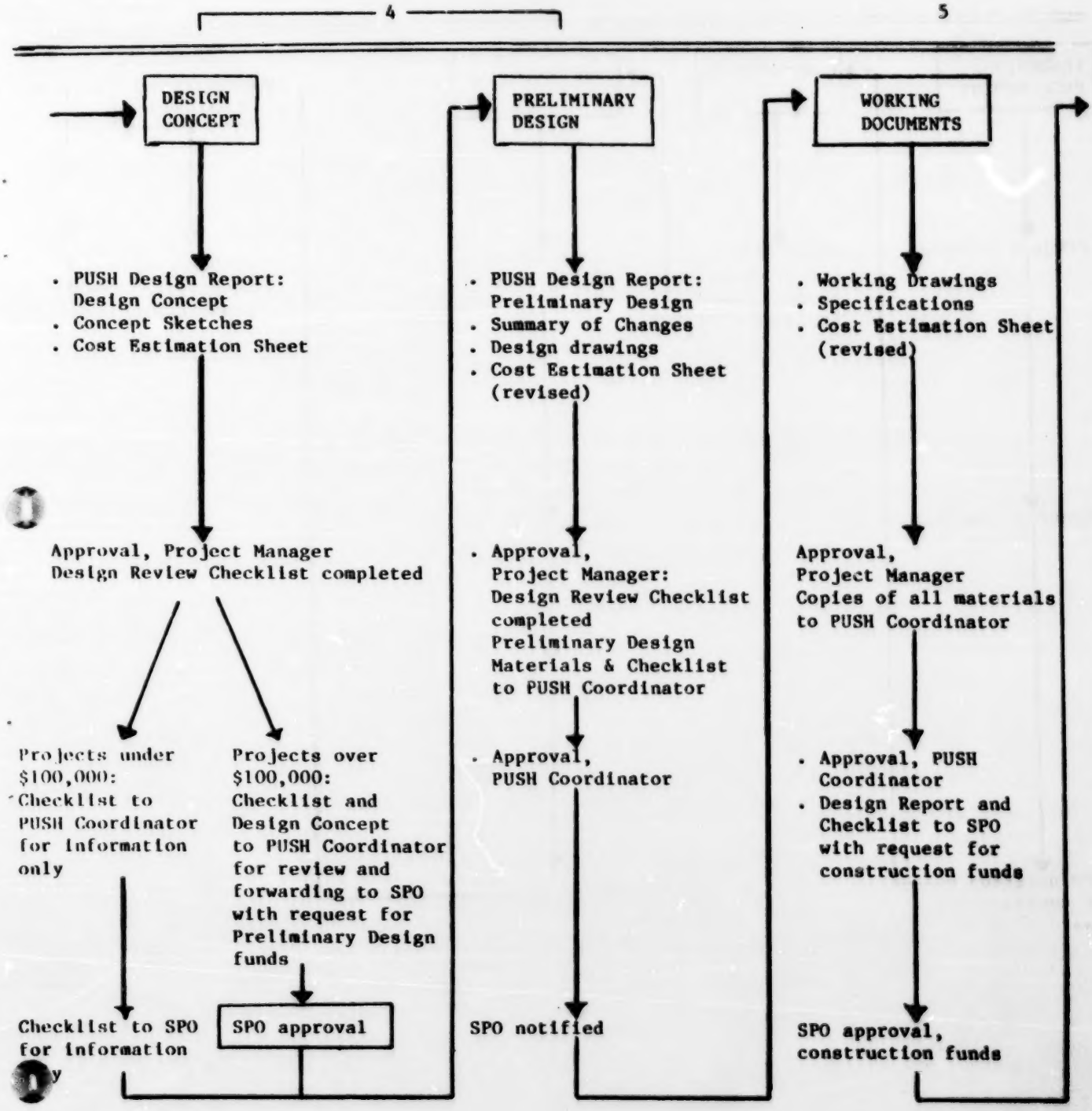
Property Manager
The Property Manager is here defined as the person within the implementing department/agency who is responsible for the management and operation of the building/facility of which the solar system will be an integral part. He (or his representative) is usually appointed to the project management team to ensure the operational viability of the system.

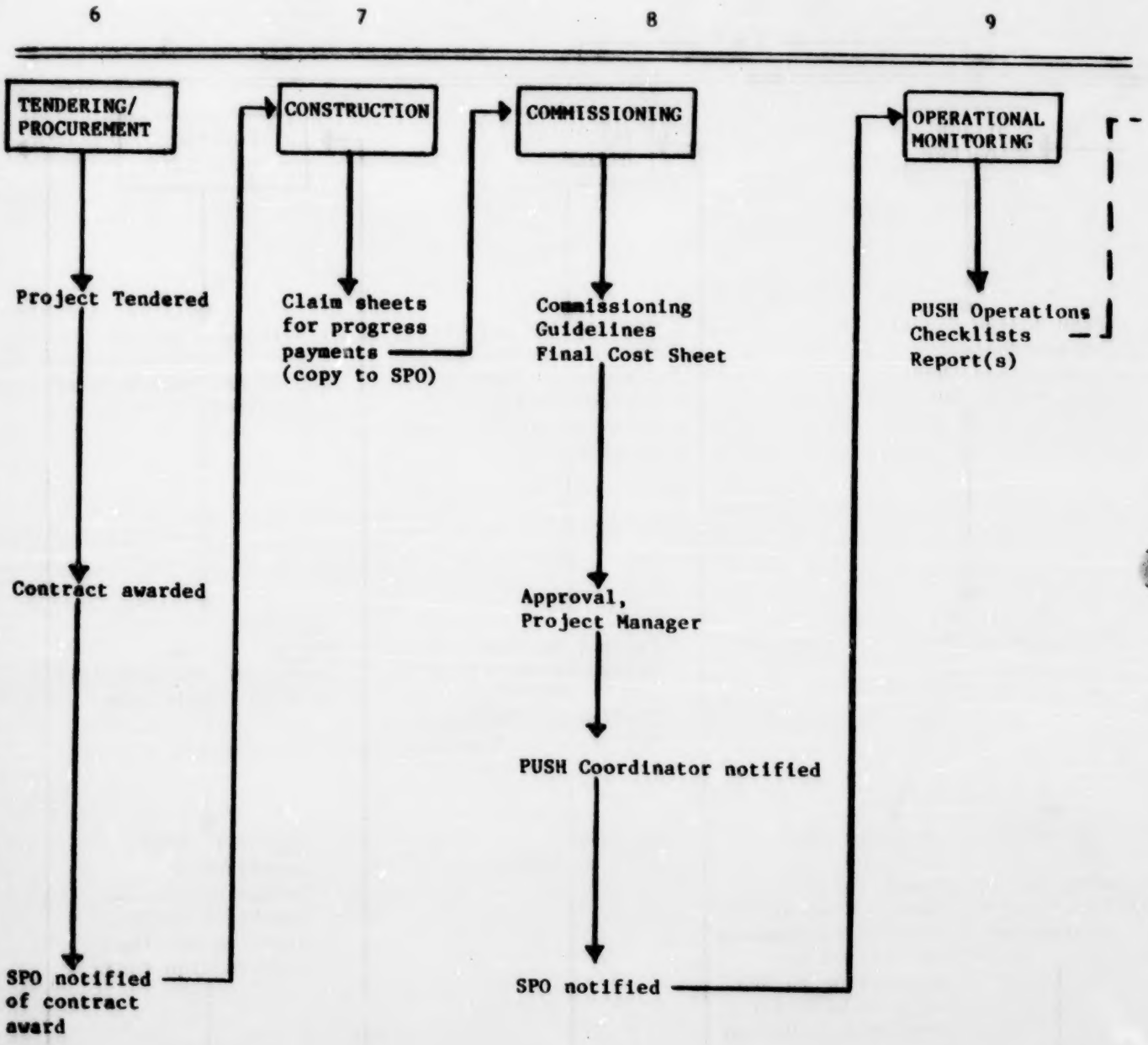
Designer
The designer is the individual or firm responsible for the design of the solar heating system, either a Canadian professional engineering design consultant or a member of the engineering design staff of the implementing department/agency.

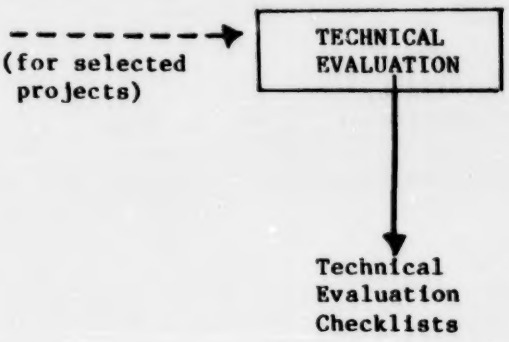
Contractor
The contractor is the main or general contractor who is awarded the installation contract and who may subcontract with other firms for various phases of the work (plumbing, electrical, etc.).

4. THE PUSH PROCESS: SCHEMATIC




4
5
DESIGN CONCEPT
PRELIMINARY DESIGN
WORKING DOCUMENTS
. PUSH Design Report: Design Concept
. Concept Sketches
. Cost Estimation Sheet
. PUSH Design Report: Preliminary Design
. Summary of Changes
. Design drawings
. Cost Estimation Sheet (revised)
. Working Drawings
. Specifications
. Cost Estimation Sheet (revised)
Approval, Project Manager Design Review Checklist completed
. Approval, Project Manager: Design Review Checklist completed Preliminary Design Materials & Checklist to PUSH Coordinator
Approval, Project Manager Copies of all materials to PUSH Coordinator
Projects under $100,000: Checklist to PUSH Coordinator for information only
Projects over $100,000: Checklist and Design Concept to PUSH Coordinator for review and forwarding to SPO with request for Preliminary Design funds
. Approval, PUSH Coordinator
. Approval, PUSH Coordinator
. Design Report and Checklist to SPO with request for construction funds
Checklist to SPO for information only
SPO approval
SPO notified
SPO approval, construction funds


6
7
8
9
TENDERING/ PROCUREMENT
CONSTRUCTION
COMMISSIONING
OPERATIONAL MONITORING
Project Tendered
Claim sheets for progress payments (copy to SPO)
Commissioning Guidelines Final Cost Sheet
PUSH Operations Checklists Report(s)
Contract awarded
Approval, Project Manager
PUSH Coordinator notified
SPO notified of contract award
SPO notified


(for selected projects)
TECHNICAL EVALUATION
Technical Evaluation Checklists

STAGE ONE: OPPORTUNITY IDENTIFICATION

Purpose: To identify potential solar heating projects for PUSH funding.

Documentation: Memo or letter to PUSH Coordinator in department, agency or Crown corporation.

Roles: A solar opportunity may be identified by:

- A staff member of any federal department, agency or Crown corporation
- Any member of the Canadian solar equipment manufacturing industry
- Any Canadian design consultant with experience in the design of solar heating systems
- A member of the Solar Programs Office

Procedure:

.1 Persons seeking to identify potential solar heating projects are referred to PUSH Document No. 1, "Identifying Opportunities to Use Solar Heating Equipment under the federal government's PUSH Program". For assistance, the PUSH Coordinator should be contacted. Names of PUSH Coordinators are available from SPO.

.2 The project identifier informs the PUSH coordinator (by telephone or mail) of the project and the PUSH Coordinator sends a copy of the PUSH Feasibility Report for completion.

.3 NOTE:

Ready-to-install package systems have been pre-designed to meet DHW loads of 150 - 450 litres/day. In such cases, the document "PUSH DHW Package System Procurement Strategy" (available from SPO or Departmental PUSH Coordinator) is to be used as a guideline for procedures.

STAGE TWO: FEASIBILITY

Purpose: To provide sufficient conceptual information and preliminary data to enable assessment of the feasibility of the proposed solar heating system prior to approval and release of design funds.

Documentation: PUSH Feasibility Report and Design Funds Application

Roles: The feasibility document will usually be completed by the project identifier (stage one). However, the following should be noted:

a) SPO does not release funds to cover completion of the feasibility document.

b) Should the project identifier or identifying agency be unable to allocate resources for completion of the feasibility document, the PUSH Coordinator should be notified. In such cases, SPO staff may provide assistance.

Procedure:

.1 Feasibility data must be submitted on a "PUSH Feasibility Report and Design Funds Application", following the methodology provided.

.2 The completed feasibility document is forwarded to the PUSH Coordinator, who verifies its completeness and accuracy and approves it.

.3 The PUSH Coordinator obtains the appropriate departmental authorities to confirm the department/agency's intent to proceed with implementation of the project pending approval of PUSH funds. These authorities will include property management agreement to provide operating and ma'ntenance support of the installed system.

.4 The PUSH Coordinator forwards the document to SPO for approval.

.5 SPO reviews comprise:

(i) Conceptual review
(ii) Technical review
(iii) Financial review

Procedure: (cont'd)

.6 SPO approves design funds in one of two ways:

(i) For projects with capital cost under $100,000 funds are approved for design concept, preliminary design and working documents, not to exceed $15,000.

(ii) For projects with capital cost over $100,000 funds are approved for design concept only.

.7 At time of approving design funds, SPO will advise the client of the level of operational monitoring and technical evaluation that will be required for the system. SPO will fund the provision of all equipment required for monitoring and evaluation. Requirements for technical evaluation and technical evaluation reports will be negotiated with designers on an individual project basis.

.8 The SPO Director transmits notice of financial approval.

STAGE THREE: PROJECT BRIEF

Purpose: To define the project and its terms of reference and to establish criteria for evaluation during design and implementation.

Documentation:
Approved Feasibility Report
PUSH Design Report (blank copy)
PUSH Document No. 4: "Architectural and Engineering Concerns in Solar System Design and Operation"
PUSH Cost Accounting Handbook
The PUSH Process
PUSH Instrumentation and Commissioning Guidelines
PUSH Technical Evaluation Guidelines (if applicable)

Roles: The PUSH Coordinator and Project Manager arrange for the appointment of a Design Consultant or the allocation of in-house design resources.

Procedure:

.1 SPO sends the required PUSH documents to the PUSH Coordinator for forwarding to the Project Manager.

.2 PUSH documents are coordinated with and assembled into the Project Brief by the Project Manager in order to define the terms of reference of the project for the designer.

.3 The Project Manager plans for the remaining stages of the PUSH process.

STAGE FOUR: DESIGN

The purpose of the Design stage is to produce a design in compliance with the terms of reference defined in the Project Brief. Stage 4 is divided into two phases:

Design Concept, in which the designer investigates a number of design options and submits the selected option for approval.

Preliminary Design, in which the approved Design Concept is developed to the point at which preparation of working documents can commence.

STAGE FOUR: DESIGN/Design Concept

Purpose: To produce a basic design concept to meet the goals and criteria outlined in the Project Brief. Development of the Design Concept is an iterative process carried out by the designer in close liaison with the Project Manager and the project team.

Documentation: Completed PUSH Design Report and Supporting Material
PUSH Instrumentation and Commissioning Guidelines
PUSH Project Cost Estimation Sheet
PUSH Design Review Checklist

Roles: The designer completes the Design Report using established design calculation methods to investigate design options and select a design concept. The designer submits three copies of the report and accompanying sketches and calculations to the Project Manager for approval.

Procedure:

.1 In-house design resources are allocated, or a design consultant is appointed in the established manner within the department/agency.* For projects under $100,000 the consultant is appointed for the complete design stage; for larger projects, the consultant is appointed for Design Concept only, pending approval of Preliminary Design Funds on the basis of the Design Concept.

.2 The Project Manager and the project team meet with the designer, outline the goals of the project, and deliver the Project Brief documentation. Instructions are given that if at any time during the design the project should appear nonviable the designer shall immediately notify the Project Manager and all work shall cease while the Project Manager contacts the PUSH Coordinator for clarification.

.3 Provision must be made in the design for inclusion of instrumentation for commissioning purposes as defined in the PUSH Instrumentation and Commissioning Guidelines.

.4 The Design Concept (three copies) must be submitted on the PUSH Design Report and include the Cost Estimation Sheet. Three copies of all accompanying materials are required:

- Photo of building/facility for which solar system is proposed
- Design calculations for energy requirements

*A list of design consultants with experience in solar technology is available from SPO or PUSH Coordinators.

Procedure: (cont'd)

- Description of energy conservation measures to be implemented
  OR: Reasons why energy conservation measures will not be implemented
- Schematic diagram (sketch) of solar system
- Description of the operation of the solar system
- Calculations, assumptions and methods used for sizing the solar system
- Design Concept Sketches - mechanical, electrical, and structural
- Description of any necessary building modifications
- Draft System Operations Manual

.5 The Design Concept is submitted to the Project Manager for evaluation:

(i) For projects under $100,000 the Project Manager completes a Design Review Checklist with notification of authorization to proceed to preliminary design, and forwards a copy of the checklist to the PUSH Coordinator. The Project Manager may request design modifications prior to giving approval and may consult the PUSH Coordinator during the approval process.

(ii) For projects over $100,000 the Project Manager completes a Design Review Checklist and forwards two copies of all Design Concept materials, with comments and recommendations, to the PUSH Coordinator. The PUSH Coordinator reviews and forwards one copy of the material to SPO with comments and recommendations.

.6 For projects over $100,000 and for Crown corporation projects, SPO carries out review and evaluation, and may request modifications. Approval of funds for preliminary design is given, and may be conditional upon specified modifications being carried out.

.7 SPO may for selected projects commit funds for construction at this stage, to be released after the PUSH Coordinator notifies SPO of Stage 4 approval.

STAGE FOUR: DESIGN/Preliminary Design

Purpose: To develop and modify the Design Concept as required to the point at which preparation of working drawings and detailed specifications can commence. The development of the design is an iterative process carried out by the designer in close liaison with the Project Manager and other members of the project management team.

Documentation: Revised PUSH Design Report and Supporting Materials
List of Changes Subsequent to Design Concept
PUSH Project Cost Estimation Sheet (Revised)
PUSH Design Review Checklist

Roles: The designer resubmits the modified Design Report and Cost Estimation Sheet, with a list of any changes made subsequent to the Design Concept. Design drawings are submitted, incorporating modifications as required.

Procedure: .1 When approval to start work on design is given, the Project Manager establishes those stages of design production at which review may be required (e.g. 33% and 66%). The frequency of review will vary according to the size and complexity of the project.

.2 Upon notification by the Project Manager of approval of the design concept and any modifications required, the designer proceeds to verify all design and cost data and develops the design for submission of Preliminary Design documents and drawings for stage 4 approval. These will include:

- Design calculations for energy requirements, if different from those submitted with the Design Concept
- Description of energy conservation measures to be implemented, if different from Design Concept
  OR: Reasons why conservation measures will not be implemented, if different from Design Concept
- Clear reproducible schematic diagram of the system for reproduction in the PUSH Project Experience Handbook, where it will appear in a size approximately 10 cm x 8 cm
- Description of the operation of the solar system, if different from Design Concept
- Calculations, assumptions and methods used for sizing the system, if different from Design Concept
- Description of any necessary building modifications, if different from Design Concept
- Design Drawings: mechanical, electrical and structural
- Draft System Operations Manual

Procedure: (cont'd)

.3 Three copies of all Preliminary Design materials including the revised Cost Estimation Sheet, are required. Design data must be in the same format as the Design Concept, i.e. on a PUSH Design Report. The options are:

(i) Submit a photocopy of the design concept version of the PUSH Design Report with changes clearly marked and a list of those changes, or

(ii) Submit only those pages containing changes, with a list of those changes.

.4 A clear reproducible schematic diagram (one copy) illustrating the operation of the system must be submitted at this time for the PUSH Project Experience Handbook (summary of PUSH projects published by SPO).

.5 The documentation is submitted to the Project Manager for review and approval. The Project Manager may wish to consider the question of pre-tendering or post-tendering of collectors for the installation, and if so is advised to contact the PUSH Coordinator to discuss the relative merits before making a decision.

.6 The Project Manager completes a Design Review Checklist to assess the design, consulting with the PUSH Coordinator if necessary. If the design is unacceptable, the material is returned to the designer for modification. If the design is acceptable the Project Manager forwards a copy the checklist to the PUSH Coordinator for review and approval.

.7 The PUSH Coordinator examines the Design Review Checklist. He may ask for a copy of the design materials and may request modifications prior to giving approval. SPO is consulted only if the size or cost estimate has changed substantially from the Design Concept.

.8 When the Preliminary Design is accepted, the Project Manager gives Stage 4 approval and authorizes preparation of working documents.

STAGE FIVE: WORKING DOCUMENTS

Purpose: To describe the project in detail for construction purposes according to standard industry conventions and practices.

Documentation: Guide to Specifying Solar Systems under PUSH Program
Working drawings
Specifications

Roles: The designer coordinates the production of working documents for approval.

Procedure:

.1 The Project Manager is notified by the PUSH Coordinator of SPO's approval of the construction budget and authorizes the designer to proceed with working documents.

.2 The designer coordinates production of
- Working drawings (one set of originals suitable for reduced size reproduction)
  - site plan
  - representative sections
  - structural plan
  - mechanical drawings
  - electrical drawings
- Specifications (30 copies)
  - based on GMS/NMS, using "Guide to Specifying Solar Systems Under PUSH Program"
- Project Schedule (30 copies)
- Cost Estimation Sheet (Final Version)
- Operations Manual (revised)

.3 The documents are delivered to the Project Manager for review and approval:

(i) Projects under $100,000: Project Manager approves documents and notifies PUSH Coordinator.

(ii) Projects over $100,000: Project Manager informs PUSH Coordinator of receipt of documents. Depending on the size and nature of the project, approval of the PUSH Coordinator (and in some cases SPO) may be required.

.4 The PUSH Coordinator sends to SPO a copy of the approved Design Report and Design Review Checklist, from Stage 4, with a request for construction funds to include overhead contingencies and administration.

In the case of Crown corporations SPO will require all design materials and construction documents for approval.

STAGE SIX: TENDERING/PROCUREMENT

Purpose: To enable contractors to bid for the installation of the solar heating system within the terms defined in the tender documents.

Documentation: Completed tender documents

Roles: As defined by the policy of the implementing department/agency.

Procedure:

.1 The Project Manager and PUSH Coordinator arrange for the preparation of all remaining documents required for the tendering process, according to standard internal practices. The tender documents must indicate that the contractor shall provide one half-day's training for maintenance staff, and shall provide a System Maintenance Manual. If required, a list of contractors with solar system installation experience is available from SPO.

Any changes to the project proposed by bidders shall be reviewed by the Project Manager to ensure that system performance and capacity would not be adversely affected.

.2 If the lowest acceptable bid is higher than the designer's estimate, the PUSH Coordinator writes or telexes to SPO requesting additional funds.

.3 The general contract is awarded. SPO is immediately notified in writing of the date of contract award, contract amount, and name of successful bidder.

.4 The project manager forwards a complete set of documents to the contractor, with a copy of the PUSH Cost Accounting Handbook. Within a specified period of time, usually 10 days of the award of the contract, the contractor is required to submit to the Project Manager a completed Project Claim Sheet containing a breakdown of anticipated costs.

.5 The Project Manager forwards a copy of the Claim Sheet to the PUSH Coordinator, who sends a copy to SPO.

STAGE SEVEN: CONSTRUCTION

Purpose: To install a complete working solar heating system according to the requirements of the working documents. The construction stage is not complete until commissioning has taken place.

Documentation: Construction Contract Documents
PUSH Cost Accounting Handbook

Roles: The general contractor and subcontractors install the system according to the working documents, reporting progress to the Project Manager.

Procedure:

.1 At agreed intervals, usually every 30 days, the general contractor submits to the Project Manager a completed PUSH Project Claim Sheet* for invoicing costs to date and other documents as required in the Construction Contract.

.2 The Project Manager ensures that the project is developed in accordance with the working documents and in a cost effective manner.

.3 Claim Sheets, with accompanying documents as required, are approved by the Project Manager and forwarded to the appropriate source for processing and payment. Copies of the accompanying PUSH Project Claim Sheets are forwarded by the Project Manager to SPO.

.4 Any modifications suggested by the contractor during the construction stage shall be approved by the Project Manager and Property Manager. Such modifications shall be reflected in the System Operations Manual and Maintenance Manual.

.5 The PUSH Coordinator ensures that a Commissioning Manager is appointed or that the Project Manager is arranging for the commissioning of the project. Operation and Maintenance Staff should be introduced to the project prior to commissioning.

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*OR a Departmental Claim Sheet itemized according to the breakdown given in the PUSH Project Claim Sheet.

STAGE EIGHT: COMMISSIONING

Purpose: To ensure that the installed solar heating system is complete and operational according to the design; to ensure an orderly transition of project responsibility from construction agency to property management agency.

Documentation:
PUSH Instrumentation and Commissioning Guidelines
Memorandum or letter from Project Manager to PUSH Coordinator
Final Project Cost Sheet
System Maintenance Manual (provided by contractor)
System Operations Manual (provided by designer)
PUSH Operations Checklist
For selected projects:
Technical Evaluation Manual (provided by designer)
Technical Evaluation Checklist (provided by designer)

Roles: The Project Manager or Commissioning Manager confirms the completion of the project as designed, verifies that it is operational and establishes its final capital cost. He supervises commissioning procedures and takes over the project from the contractor.

Procedure:

.1 All PUSH projects must be commissioned according to the standards outlined in the "PUSH Instrumentation and Commissioning Guidelines". Provision for instrumentation necessary for proper commissioning must be made by the designer at the final design stage.

.2 The Project Manager arranges for commissioning of the project after receipt of the contractor's final invoice but prior to approval for payment.

.3 Commissioning is conditional upon:

(i) The main contractor delivering to the Project Manager three copies of a System Maintenance Manual to provide guidelines for maintenance staff containing:

a) Maintenance instructions for system components
b) Names, addresses and phone numbers of all sub-contractors and suppliers
c) Details of guarantees
d) One complete set of "as-built" drawings;

(ii) The main contractor providing one half-day's training for maintenance staff;

Procedure: (cont'd)

(iii) The designer providing two copies of a System Operations Manual.

(iv) For those projects selected by SPO for technical evaluation, the designer delivering to the Project Manager two copies of a Technical Evaluation Manual containing a detailed description of evaluation procedures.

.4 Commissioning is also conditional upon delivery by the contractor to the Project Manager of photographs of the completed installation. Details of photographic requirements are contained in the "PUSH Project Commissioning Guidelines".

.5 Commissioning will usually be carried out by the installation contractor, who must demonstrate to the Project Manager or Commissioning Manager, usually in the presence of the designer and owner, that the system is in full working order to specified design requirements.

.6 As soon as the project is commissioned, the Project Manager delivers to Property Administration/building maintenance staff the System Maintenance Manual and six copies of the PUSH Operations Checklist.

.7 As soon as possible after commissioning (preferably the same day) the contractor provides one half-day of instruction to building maintenance staff on operation and maintenance procedures. A PUSH Operations Checklist is completed.

.8 For those projects selected for technical evaluation: As soon as possible after commissioning, preferably the same day, the designer provides one half-day's instruction to maintenance staff regarding completion of the Technical Evaluation Checklist.

.9 The Project Manager completes the final Project Cost Sheet (see Cost Accounting Handbook) and approves the final invoice for payment.

.10 The Project Manager forwards to the PUSH Coordinator the following documentation:

- Letter or memo confirming commissioning of project
- Copy of Final Project Cost Sheet
- System Maintenance Manual

Procedure: (cont'd)

- System Operations Manual
- Completed PUSH Operations Checklist
- Technical Evaluation Manual (if applicable)
- Photographs

.11 The PUSH Coordinator notifies SPO of the completion of the project with copies of the above documentation, and confirms with SPO the arrangements for project operations monitoring and, if applicable, for technical monitoring.

STAGE NINE: OPERATIONAL MONITORING

Purpose: To verify and record the operational performance of the system to ensure that it is working effectively.

Documentation: System Maintenance Manual (provided by contractor)
PUSH Operations Checklist.

Roles: For all PUSH projects, building maintenance staff complete the PUSH Operations Checklist at prescribed intervals and submit to the PUSH Coordinator for forwarding to SPO.

Procedure:

.1 Maintenance staff should refer to the System Maintenance Manual for guidance and instructions in day-to-day operations and maintenance.

.2 Building maintenance staff complete a copy of the PUSH Operations Checklist at the following intervals:

- First report within 60 days of commissioning
- Three subsequent reports at six month intervals
- Two subsequent reports at one year intervals

The checklist contains no technical data, but provides a record of general performance, down-time and repairs. Checklists are forwarded to the PUSH Coordinator for submission to SPO.

STAGE TEN: TECHNICAL EVALUATION

Purpose: To collect data regarding the long-term performance and reliability of solar system and components; to obtain feedback for improvement of technical criteria and procedures.

Documentation: Technical Evaluation Manual
Technical Evaluation Checklist

Roles: For those projects selected by SPO for technical evaluation at the Feasibility Stage, the Technical Evaluation Checklist is completed by maintenance staff and forwarded to SPO at prescribed intervals.

Procedure:

.1 Maintenance staff complete the Technical Evaluation Checklist at intervals prescribed by the designer in the Technical Evaluation Manual.

.2 Completed checklists are forwarded by maintenance staff to SPO for analysis.

POOR

QUALITY

ORIGINAL